Lessons Learnt from Taiwan’s High Speed Rail

Cheng-Min FENG
Professor
Institute of Traffic and Transportation
National Chiao Tung University
4F, 118, Sec. 1, Chung Hsiao W. Rd., Taipei
10012, Taiwan, ROC
Fax: +886-2-2349-4965
E-mail: cmfeng@mail.nctu.edu.tw

Abstract: Taiwan takes BOT approach to build and operate its high speed rail. Several issues such as the enact of new law vs. the modification of old law, tri-party agreement vs. two-party agreement, partner or regulator, refinance vs. take-over, new town vs. old town, expropriation or zonal expropriation, and plan vs. development, occurred during the planning, construction, contracting and operation periods. Taiwan learns its lessons from the process and its outcomes, which could help others to prevent the issues or adapt their plans.

Key Words: high speed rail, BOT, issues, lessons

1. INTRODUCTION

There is an increasing need to build new transportation infrastructure to meet the intercity travel needs in western Taiwan. However, at the same time, there is a decreasing amount of government funds available to finance the infrastructure, and a decreasing tolerance among taxpayers or transportation user to increase taxes or user fees. One alternative solution is to build high speed rail (HSR) in Taiwan with the participation of private sector.

In the planning and design stage, the most of arguments lie in the location of station, the acquisition of land, station area’s plan and design, and who will construct and operate the HSR, which were all determined by the government. In the operation stage, the refinancing to make the private sector financially sustainable, the station area development, and the transit feeder system of station connection become important issues. This paper will first discuss why we need HSR, and the BOT (Build-Operate-Transfer) approach. Then the plan of station area and adjacent urban district, and the land acquisition scheme will be explored. Finally, this paper will disuse the lessons learnt from Taiwan’s HSR.

2. WHY WE NEED HIGH SPEED RAIL

The rapid economic development in Taiwan during 1980-1990 placed a heavy burden on the regional transportation infrastructure, particularly along the western Taiwan corridor. The 95% of Taiwan’s 23 million populations is concentrated in the western Taiwan corridor, which
has an area of about 25,600 square kilometers only. This high average population density of 750 persons per square kilometers along the corridor and the increasing car ownership due to the growing per capita income have caused serious traffic congestion along the intercity highways. The existing narrow gauge railway has maximum design speed of 120 km/hr and has continuously lost its competitiveness due to entrances of other modes. The short intercity distances in Taiwan and limited capacity of domestic airport have constrained the development of domestic air transportation market.

The increasing value of time, the congestion on existing intercity highways and the constraint of conventional railway and domestic air transportation, Taiwan’s government looked for a new way to meet the intercity travel demand in western Taiwan. The HSR was evaluated as the best solution for serving demands and also meet the transportation policy objectives of improving public transportation and minimizing negative environmental impacts. The benefits of introducing HSR include:

1. to fill the intercity transportation gap of the demand for transportation service with higher speed and higher capacity. (Figure 1)
2. to shorten the north-south travel time from 4 hours to 1.5 hours and thus change the national spatial structure to a one-day-activity zone. (Figure 2)
3. to form an efficient mass transportation network connecting HSR with conventional railway and urban mass rapid transit systems.
4. to provide a safer, faster, more reliable, energy efficient and environment friendly mode.
5. to promote the local economy prosperity through the development of HSR station area and adjacent urban district.

Source: Bureau of Taiwan High Speed Rail (BOTHSR)
The total length of HSR is 345 kilometers. It will take about 90 minutes from Taipei to Kaohsiung with operation speed of 300 km per hour. The HSR will go through 12 stations including Nangang, Taipei, Banciao, Taoyuan, Hsinchu, Miaoli, Taichung, Chunghua, Yunlin, Chiayi, Tainan, and Zuoying stations, where Miaoli, Chunghua, and Yunlin are the three future stations, and Nangang and Banciao are considered as satellite stations for Taipei (Figure 3). Although there are many stations, each train will stop at the most of 4 stations to make the trip in 90 minutes from Taipei to Kaohsiung. The fare of HSR will range between conventional railway and airline. The total cost of this project is estimated to be US$ 15 billion. To reduce the government the financial burden and take advantage of the efficiency of the private sector, the HSR project takes BOT approach. The government gives Taiwan High Speed Rail Corporation (THSRC) 35 years concession period to build and operate HSR and 50 years to develop and operate station enterprise development land. After the expiration of concession periods, THSRC will transfer the operation assets back to the government.

3. BOT OF HSR

Source: BOTHSR

Figure 2 Restructure of national development pattern
Proceedings of the Eastern Asia Society for Transportation Studies, Vol.8, 2011

Profile

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>345 Km</td>
</tr>
<tr>
<td>Speed</td>
<td>300 Km/hr</td>
</tr>
<tr>
<td>Time (Taipei-Kaohsiung)</td>
<td>90 Minutes</td>
</tr>
<tr>
<td>Station</td>
<td>12 Station</td>
</tr>
<tr>
<td>Cost</td>
<td>US$15 billion</td>
</tr>
<tr>
<td>Privatization Type</td>
<td>BOT</td>
</tr>
<tr>
<td>Concession Period (Construction and Operation)</td>
<td>35 years</td>
</tr>
<tr>
<td>Concession Period (Land Development)</td>
<td>50 years</td>
</tr>
</tbody>
</table>

Figure 3 Stations and profile of HSR

The scope of construction and operation invested by THSRC is as follows (THSRC, 2004):

1. Construction: design and construction of HSR route, stations, depots, track work, core engineering and mechanical systems, and affiliated facilities.

2. Operation: provision of passenger transport service; operation of station development; maintenance, repairs, replacement and additional installation of ancillary civil construction and operational facilities.

Since the HSR is the first BOT rail project in Taiwan and is the world’s biggest BOT project, there are several issues such as the financial affordability of the private sector, the transportation system integrations which are needed to be resolved.

4. WHERE ARE THE LOCATIONS OF HSR STATIONS?

There were debates about the locational issue of HSR station. The new town location finally wins the game. The reason for this is that station located at new town could avoid huge costs on land acquisition, people relocation and environmental protection compared to location at the existing central city or jointly with the existing conventional rail station. Besides, new town development with new HSR station could create a new urban image and
better quality of life which the existing city may not be easy to have. However, this new town development approach implies the additional costs of transportation links between new town and existing town, and market risks of real estate development (Figure 4). These arise from the fact that due to the town’s relatively isolated location, there may be insufficient demand to make the development viable. In short, there is a trade-off between higher development costs and limited demand on the one hand, and low land acquisition costs on the other. After all, there is a long lead time for the population of new towns to reach the target population, e.g. 50,000 and to attract sufficient industrial investment that will create employment opportunities.

<table>
<thead>
<tr>
<th>New Town Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantage</strong></td>
</tr>
<tr>
<td>- Low land acquisition cost</td>
</tr>
<tr>
<td>- New urban image</td>
</tr>
<tr>
<td>- Better quality of life</td>
</tr>
<tr>
<td><strong>Disadvantage</strong></td>
</tr>
<tr>
<td>- Additional access cost</td>
</tr>
<tr>
<td>- Higher market risk</td>
</tr>
</tbody>
</table>

Figure 4 Location of HSR station

5. WHAT ARE THE STATION AREA AND ADJACENT URBAN DISTRICT PLAN

The station area includes both station land used for station, passenger transfer facilities, parking areas and other transportation facilities, and enterprise development land for commercial use such as hotels, restaurants, recreational/entertainment venues, department stores/retailers, banks, and other station-dependent businesses.

Around the station area, there is so-called urban plan of special district. There are five major urban special district plans adjacent to stations of Taoyuan, Hsinchu, Taichung, Chiayi and Tainan stations. The five plans have been given different functions tailored to the local development characteristics (See Table 1). The population for these five special districts ranges from 20 thousands to 60 thousands, while the area from 135 hectares to 490 hectares. Since the Taoyuan station is located nearby the Chiang Kai-Shek (CKS) international airport, the special district of Taoyuan station has taken this advantage to position this area as a convention/exhibition center. Considering the local characteristics, Hsinchu special district is planned as a bio-park center, Taichung as a mega mall and international procurement center, Chiayi as a palace garden and Tainan as an ecopolis.
Table 1 The function of urban special district plan for five major stations

<table>
<thead>
<tr>
<th>Item/ Station</th>
<th>Taoyuan</th>
<th>Hsinchu</th>
<th>Taichung</th>
<th>Chiayi</th>
<th>Tainan</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special District Area (ha)</td>
<td>490.0</td>
<td>309.22</td>
<td>273.35</td>
<td>135.22</td>
<td>298.93</td>
<td>1,506</td>
</tr>
<tr>
<td>Planned Populations (person)</td>
<td>60,000</td>
<td>45,000</td>
<td>23,000</td>
<td>20,000</td>
<td>32,000</td>
<td>180,000</td>
</tr>
<tr>
<td>Position</td>
<td>Convention and Exhibition Center</td>
<td>Bio Park</td>
<td>Mega Mall (International Procurement Center)</td>
<td>Palace Garden</td>
<td>Ecopolis</td>
<td></td>
</tr>
<tr>
<td>Commercial/ Manufacturing Park (ha)</td>
<td>21.90</td>
<td>38.30</td>
<td>15.23</td>
<td>9.84</td>
<td>47.16</td>
<td>132.43</td>
</tr>
</tbody>
</table>

Resource: BOTHSR

In each of five stations, a Commercial/Manufacturing Park (C/M Park) is designated nearby the station area. The land use regulation for the C/M Park is flexible, ranging from company headquarters, R & D and design centers, to convention centers, financial districts, or entertainment and shopping centers. There are 132 hectares of C/M Park, out of a total urban special district area of 1506 hectares. The government is responsible for the development of the C/M Park.

6. HOW TO ACQUIRE THE LAND

The land used for the HSR project is 345 Km in length and 18m in width, passing 14 counties and cities. The land acquisition process begun in 1995 by means of expropriation, purchase, leasehold, and agree-to-use. This land acquisition has been completed and these lands have been handed over to THSRC.

To acquire the land of station area, the government takes the approach of zone expropriation. The zone expropriation covers the areas of station areas and adjacent urban planning area of Taoyuan, Hsinchu, Taichung, Chiayi and Tainan stations. To process zone expropriation, the finance to implement it has to be proven as feasible, that is, self-financing. The land distribution in the implementation of zone expropriation is an importation task which includes the settlement and land distribution for the relocated households, the distribution of compensatory land, and the distribution of land reimbursement with priority by original owners.

Zone expropriation is a technique of land readjustment and a self-financing land administrative measure. Through the zone expropriation, a group of separate land parcels are assembled within the framework of a comprehensive plan into a unified site which can then be subdivided for the development purposes. Not only the HSR bureau can get station area land free of charge but also can eliminate the unfairness caused by different zoning among lands. In addition, the increased land value after land development in the area of zone expropriation will be captured to finance its development cost through the surplus of land price gained via auction sale of cost recovery land.

To assure the self-financing, the area of zone expropriation is larger than the area of station
area. It includes the land of station area, the land to be returned to landowners, and the land for recovering the zone expropriation cost (Figure 5). This cost recovery land is temporarily owned by the government and will be sold on the open market to recover the costs of public facilities such as roads, parks and schools in the area of zone expropriation.

Through this zone expropriation method, the government can effectively acquire the station area land and promote comprehensive urban development in urban planning area, and the landowners can redeem 40%~50% of their expropriated area in principle without loss of their rights. Although the land redeemed is reduced as compared with the original area, however the land value will greatly increase due to up-zoning of land use. Besides, the living environment can be improved because the government has a comprehensive plan and is responsible for the construction of public facilities in the area of zone expropriation.

Two types of lessons learnt from Taiwan’s HSR are discussed as follows:

1) **BOT Lessons**

   (1) **the enact of new law vs. the modification of old laws**
   In order to promote private participation in public transportation infrastructures, the government had an argument between enacting a new law or modifying the related old laws. Having reviewed the factors of complication and time consuming of modifying the related old laws, the Ministry of Transportation and Communications (MOTC) drafted the Statute for Encouragement of Private Participation in Transportation Infrastructure Project at the end of 1991, which was formally announced and implemented on Dec. 1994, and is the legal basis for HSR development.

   (2) **tri-party agreement vs. two-party agreement**
   In the contracting stage, the banker plays an important role to ensure the project can be financially sustainable. In Taiwan, the bankers are familiar with the mortgage loan and do not get used to this project financing so that they do not have the capability to evaluate this huge rail project. Eventually, the bankers would like to give loans to THSRC under the condition of government endorsement. It is better in the bidding stage, the bidders should provide the letter of financing intent from the bankers, and in the contracting stage, three key players (government, THSRC, and bankers) should sign
the tri-party agreement rather than two players (government, THSRC) sign the two party agreement. Besides, in the tri-party agreement, the roles among three parties should be clearly defined.

(3) **partner or regulator**
In the part, the government officials always play a regulator role, and are afraid of discreditable collusion between officials and businessmen, which has made government officials pay much concern over profiteering, or profit transfer when dealing with the private participation projects. However, for BOT projects, government officials need change this attitudinal barrier. As a partner, government officials should establish an one-window office to assist the private sector in the explanation of laws, the governmental matters such as land acquisition, the relocation of pipelines and etc.

(4) **refinance vs. take-over**
During the initial operation period, the operation revenue (OR) could not cover the operation cost (OC) for THSRC at the beginning year, however, this situation has been improved soon when the passengers increase. The current operation ratio (OR/OC) in 2010 has been greater than 1 although the operation revenue is still insufficient to pay the interest and depreciation. THSRC suggested to the government in February 2009 that the conditions for termination of the contract had been reached; and both parties need to re-negotiate to find a resolution. The government decides to help THSRC in refinancing as a partner instead of the take-over option because it could minimize the social, economic and political impact. The refinancing plan (Ju, 2010) is to initiate a new syndicated credit contract with a lower interest rate in order to pay back the old loan, and to lengthen the principal repayment period, under the principles of the continuation of original contract and no increase of debt amount.

2) Station Development Lessons

(1) **new town vs. old town**
The HSR station located either in new town or old town has its advantage and disadvantage. Taiwan takes new town approach with a station rail-link plan. However, the station rail-link plan has not happened until now due to government financial difficulties. This causes inconvenience and the additional access cost and time to HSR passengers, and discourages the real estate development in station area. The mitigation strategy in Taiwan now is to introduce the free access shuttle bus connecting the station and old town by THSRC. We learn that the issue is not on the choice of new town or old town but on having an acceptable connection time and cost to HSR station.

(2) **expropriation or zonal expropriation**
Acquiring the land for infrastructures in Taiwan has become a more difficult work due to the land owner’s protest. To reduce the barrier of land acquisition, Taiwan takes the zonal expropriation approach. The main advantage of zonal expropriation over expropriation is that landowner can choose to take money back or to take 40% of original land area with appreciated land price due to the up-zoning. This benefit of zonal expropriation did reduce the land owners’ dissatisfaction and acquisition harrier.

(3) **plan vs. development**
A visionary land use plan in a station area may not come true without a marketable
development scheme. Taiwan has made several good station areas plans which have been approved by the Ministry of Interior. However, these plans has not yet been easily carried out in a short time simply because the property development strategies are not included in the original plan, the station accessibility is not so good, and the development needs longer time. It concludes that a beautiful land use plan without the consideration of property market could not make the plan happen.

REFERENCES

Bureau of High Speed Rail (BOTHSR). (1992) Taiwan West Corridor High Speed Rail.

Bureau of High Speed Rail (BOTHSR). (2004a) Taiwan High Speed Rail.


Taiwan High Speed Rail Corporation (THSRC). (2004c) Taiwan High Speed Rail.